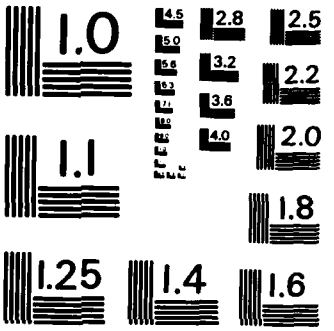
AD-A146 240 EVALUATION OF SURVIVAL STRAWS (POCKET PURIFIER)(U) 1/1
ARMED FORCES FOOD SCIENCE ESTABLISHMENT SCOTTSDALE
(AUSTRALIA) G F THOMSON ET AL. JUN 84

UNCLASSIFIED F/G 6/7 NL

END

FILMED

DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

AR-003-573

UNCLASSIFIED

AD-A146 240

EVALUATION OF SURVIVAL STRAWS

(POCKET PURIFIER)

G. F. THOMSON

G. DRIVER

DTIC
SELECTE
OCT 2 1984
D
A

ARMED FORCES FOOD SCIENCE ESTABLISHMENT

SCOTTSDALE. TASMANIA

DTIC FILE COPY

APPROVED

FOR PUBLIC RELEASE

© Commonwealth of Australia

JUNE. 1984

DEPARTMENT OF DEFENCE

THE UNITED STATES NATIONAL TECHNICAL INFORMATION SERVICE IS AUTHORISED TO REPRODUCE AND SELL THIS REPORT

UNCLASSIFIED

84 09 25 016

CONTENTS

EVALUATION OF SURVIVAL STRAWS

SUMMARY

Preliminary results raise some doubts as to the bactericidal efficiency of Survival Straws. The possible inactivation of the bactericidal resin in the straw by the Simulated Contaminated Water employed, would need to be investigated before further studies could proceed.

INTRODUCTION

This report is a preliminary report of microbiological studies on Survival Straws (Pocket Purifier). The trial was undertaken as part of the overall study on water purification systems.

Survival Straws were obtained from their manufacturer Calco Ltd., Rosemont, U.S.A. via their Australian distributor. Three straws were also forwarded by the RAAF.

The Survival Straw is used by placing the bottom end in water and drawing water through the tube as with an ordinary "drinking straw". The straw as housed in a protective casing is 21 cm long and 1.6 cm in diameter. There are three main sections in a straw (Figure 1). The first is a primary inlet filter to remove suspended particle matter. The second is a halogenated polystyrene divinyl-benzene quarternary ammonium anion resin containing 38% iodine. This section is alleged to kill micro-organisms. The third is a purifying medium of carbon to remove impurities and make the water palatable.

The manufacturers claim that the Survival Straw will produce water that is microbilogically potable, and palatable from any non-saline source. The manufacturers further claim that the purifying life expectancy of the Straw is greater than its filtering capacity. Thus it can be used until water can no longer be drawn into the mouth.

MATERIALS AND METHODS

The apparatus used in this study to draw water through the Survival Straw is illustrated in Figure 2.

One end of the survival straw was suspended in 1 litre of water seeded with *Staphylococcus aureus* N.C.T.C. 6571, *Pseudomonas aeruginosa* N.C.T.C. 6749 and *Escherichia coli* N.C.T.C. 8196. The inoculated water was prepared by addition of 0.5 mL of an overnight culture of each organism in nutrient broth medium, per litre of water. The trial concentration of bacteria was approximately 10^7 mL^{-1}. The exact concentration is shown in the appendices A & B. The water, a simulated contaminated water (S.C.W.) (Appendix C) was drawn through the survival straw by vacuum, into a side arm flask. The vacuum used was varied between 23 cm (water), which was just sufficient to draw water through the survival straw, and 80 cm (water) which a survey of laboratory staff indicated was the average maximum mouth vacuum. The pH of the seeded water was varied between pH 4 and pH 10 and all tests were carried out at ambient temperature. Any active agent carried over from the straw was neutralised with sodium thiosulphate (10% $^{w}/_{v}$ W.H.O. 1971).

The standard plate count (S.P.C.) method as described in AS 1095.4.1.2 (S.A.A. 1981) was used to determine the total number of viable bacteria present. *E. coli* were enumerated by the method of Anderson and Baird-Parker (1975).

The palatability of water treated through the Survival Straw was evaluated against tap water and water treated with Afses and Potable Aqua water sterilising tablets. The evaluation was conducted by a taste panel using the Ranking Method. Parisian essence was used to impart a colour similar to Afses treated water. The values obtained were adjusted to convert them to normally distributed values, so as to facilitate statistical analysis (Amerine, Pangborn & Roessler, 1965). Statistical analysis used Duncan's New Multiple Range Test, with tables of significance at the 5% level (Beyer, 1968).

DTIC COPY INSPECTED 2

Accession For
NTIS GRA&I
DTIC TAB
Unannounced
Justificati
By
Distribution/
Availability Codes
Dist | Avail and/or Special
A-1

RESULTS AND DISCUSSION

Table 1 shows the results obtained from straw A when tested on 3 seperate days. On the first day using the minimum vacuum of 23 cm (water) and various pH's the efficiency of kill of the survival straw was >99.9%. This conforms to the quality control specification for Water Purification Tablets (Logistic Command Interim Specification 1975). Tests on day 2 at either end of the pH scale again yielded kills >99.9%. On day 3, straw A was again tested at varying pH's but the vacuum used was the maximum of 80 cm (water). On this occasion straw A failed the specification of 99.9% kill with respect to S.P.C.

Table 2 shows the results from straw B, where the influence of water flow rate on survival rate was examined. On the first day (day 1) of testing, straw B produced water capable of meeting the specification.

On day 2 the results (Table 2) showed failure of straw B to meet the specification with respect to S.P.C. at each of the vacuums used. The rate of flow on either ocasion did not affect the survival rate.

Table 3 details the taste panel rank totals for flavour of treated water. Tap water was considered significantly more palatable ($P<0.05$) than water treated through the Survival Straw or treated with either Afses or Potable Aqua. Survival Straw treated water was considered more palatable than Afses treated water. There was no significant difference between the Afses and Potable Aqua treatments.

CONCLUSION

The applications of the Survival Straw would be individual field sterilisation of water for aircrew and small combat units. In both cases it is desirable to minimize the weight and volume of the individual sterilizing equipment. These straws are much bulkier and heavier than the sterilizing tablets currently available for use. The Survival Straws can only be used for drinking purposes: treated water would not be available for use with beverage, fruit drink powders or freeze-dried meals.

The bacteriological results obtained to date raise doubts as to the efficiency of the Survival Straws. With each straw the initial results were very promising but failed on subsequent usage. It may be that S.C.W. utilised is inactivating the bactericidal resin. The manufacturer does advise that the Survival Straw is not suitable for salt or brackish water. S.C.W. contains .0538 gL^{-1} sodium chloride which is far less than the average for seawater (35 gL^{-1}). Further work on this area of inactivation is necessary before microbiological studies could continue.

Although water treated through Survival Straws was considered more palatable than Afses treated water, service use of the straws in not recommended. This is due to the microbiological failures on repeated use, and their size relative to the sterilising tablets currently available.

ACKNOWLEDGEMENTS

The authors wish to thank Mrs. J. Brown and Mr. A. Hancock for their technical assistance.

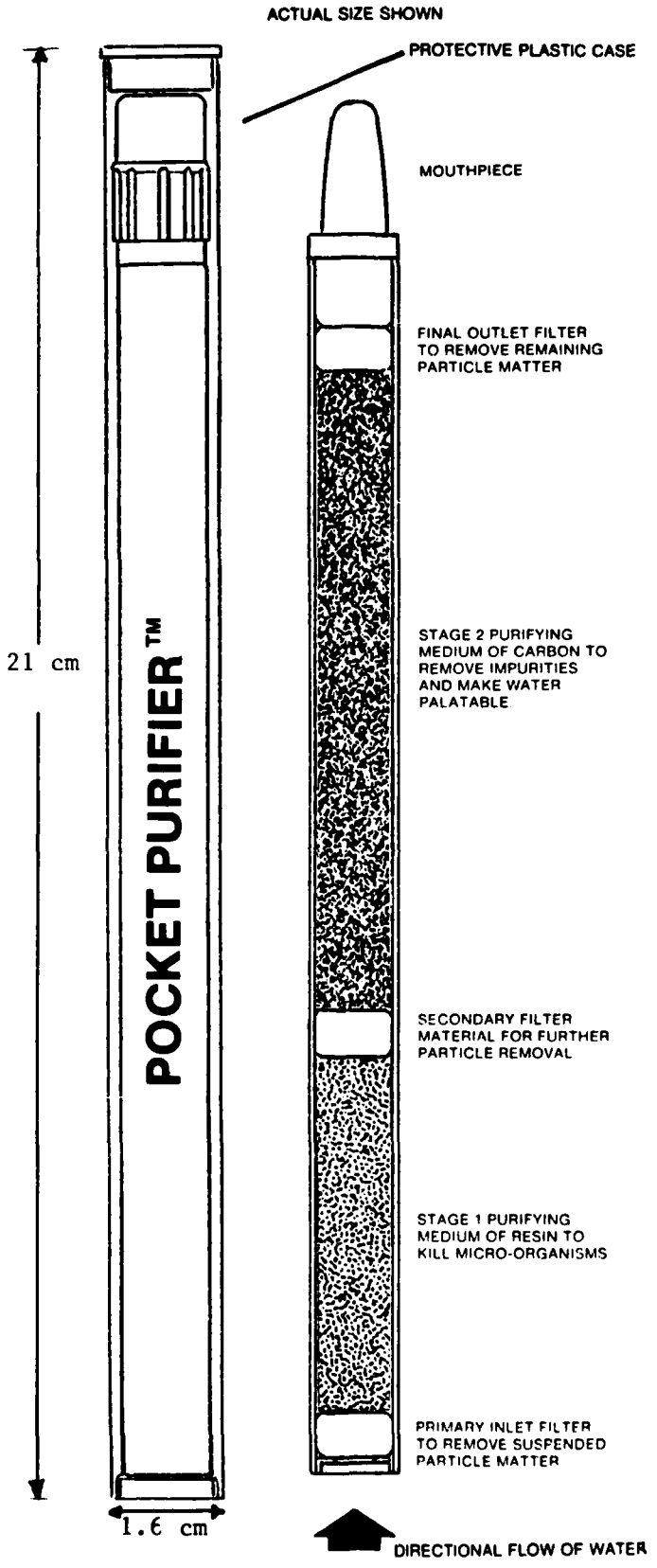


Figure 1
The Survival Straw

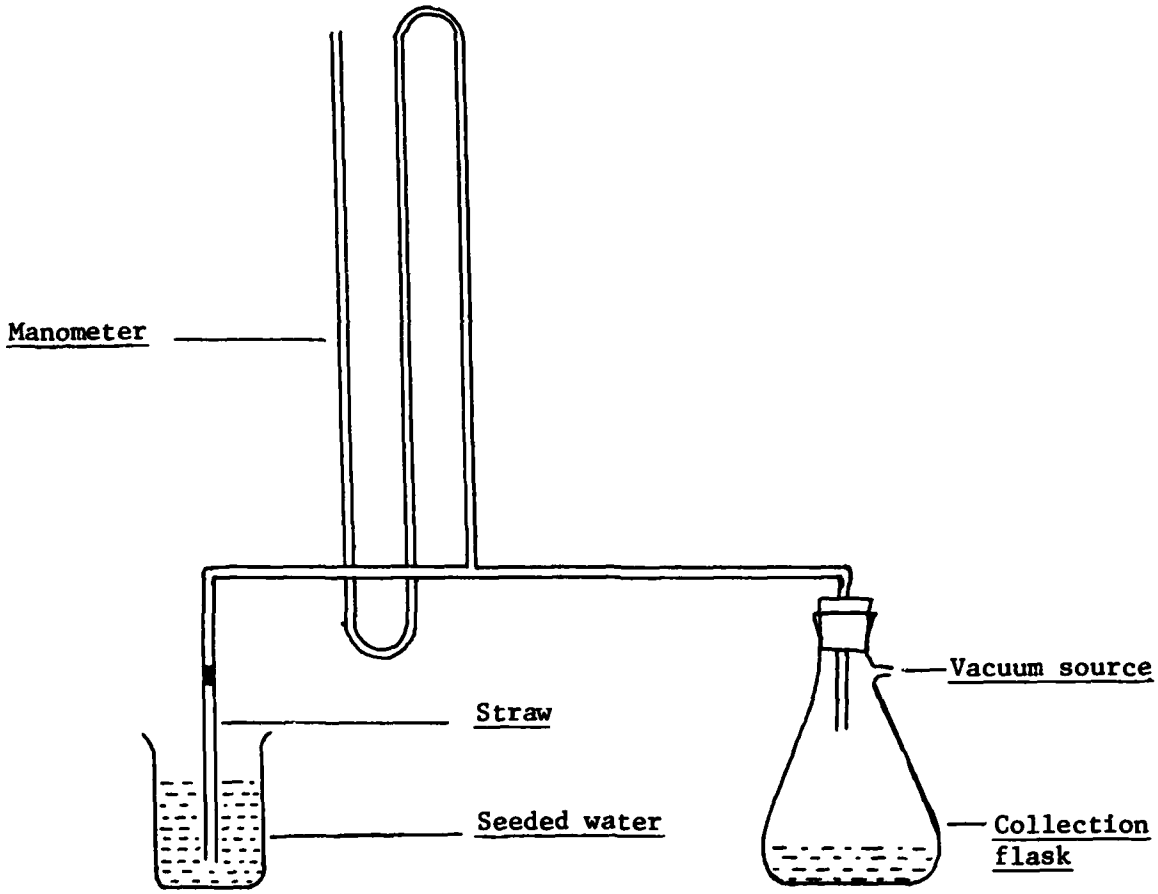


Figure 2
Apparatus for drawing water through Survival Straws.

TABLE 1

Efficiency of kill of Survival Straw A at various pH's and vacuums.

DAY	pH	Vacuum (cm water)	% Kill S.P.C.	% Kill Coliforms
1	4	23	99.999	> 99.997
	6		99.999	> 99.997
	7		> 99.999	> 99.997
	8		> 99.999	> 99.997
	10		> 99.999	> 99.997
2	4	23	99.996	> 99.999
	10		99.943	> 99.999
3	4	80	99.888	> 99.997
	6		< 99.610	> 99.997
	7		< 99.610	> 99.997
	8		< 99.610	> 99.997
	10		99.988	> 99.997

TABLE 2

Efficiency of kill of Survival Straw B at various pH's and vacuums.

DAY	pH	Vacuum (cm water)	% Kill S.P.C.	% Kill Coliforms
1	7	23	99.997	>99.996
		33	99.999	>99.996
		40	99.999	>99.996
		50	>99.999	>99.996
		60	>99.999	>99.996
2	6	24	99.833	>99.997
		40	98.666	>99.997
		60	99.675	>99.997
		80	99.675	>99.997

TABLE 3

Taste panel rank totals for flavour of treated water.

Tap Water	Survival Water	Potable Aqua	Afses
9.57	.60	-2.53	-7.64

(Rank totals not connected by a line below are judged to be significantly different at the 5% level).

REFERENCES

Amerine, M.A., Pangborn, R. M. & Roessler, E.B., 1965.
Principles of Sensory Evaluation of Food. Academic Press.

Anderson, J. M., Baird-Parker, A. C., 1975.
A rapid and direct plate method for enumerating *Escherichia coli* biotype 1 in Food. J. Appl. Bact. 39, 111-117.

Beyer, W. H. (Ed) 1968.
Handbook of tables of probability and statistics. C.R.C., 371-373.

Logistic Command Interim Report Specification.
Water sterilizing tablets. S.X.3.9. Dec., 1975.

Standards Association of Australia, 1981.
Australian Standard 1095.4.1.2. Microbiological methods for the dairy industry. Examination of water for colony count by the pour plate method.

World Health Organisation, 1978.
International standards for drinking water. 3 Ed. Rep.

APPENDIX A

Total and Coliform counts enumerated from inoculated simulated contaminated water before and after treatment through Survival Straw A.

DAY	pH	Vacuum (H_2O)	Initial mL^{-1}		Post Straw mL^{-1}	
			S.P.C.	Coliform	S.P.C.	Coliform
1	4	23 cm	$8.5x10^5$	$3.7x10^4$	8	<1
	6				2	<1
	7				<1	<1
	8				<1	<1
	10				<1	<1
2	4	23 cm	$1.0x10^6$	$1.4x10^5$	33.5	<1
	10				$5.7x10^2$	<1
3	4	80 cm	$7.7x10^5$	$4.0x10^4$	$8.6x10^2$	<1
	6				$>3.0x10^3$	<1
	7				$>3.0x10^3$	<1
	8				$>3.0x10^3$	<1
	10				88.5	<1

APPENDIX B

Total and Coliform counts enumerated from inoculated simulated contaminated water before and after treatment through Survival Straw B.

DAY	pH	Vacuum (H_2O)	Initial mL^{-1}		Post Straw mL^{-1}	
			S.P.C.	Coliform	S.P.C.	Coliform
1	7	23 cm	$9.8x10^5$	$6.0x10^4$	29	<2
		33			9	<2
		40			3	<2
		50			<1	<2
		60			<1	<2
2	6	24 cm	$1.2x10^6$	$7.8x10^4$	$1.4x10^4$	<2
		40			$1.6x10^4$	<2
		60			$3.9x10^3$	<2
		80			$3.9x10^3$	<2

APPENDIX C

Formulation of Simulated Contaminated Water

Compound	g L^{-1}
$Na_2PO_4H_2O$	0.0812
NaK Tartrate	0.0404
L. Cysteine HCl	0.0104
Starch (Soluble)	0.0010
$(NH_4)_2SO_4$	0.0094
NaCl	0.0538